INSTRUCTIONS

Model 3121 Grease Conversion Kit

For Model 3102, 3103, 3106, 3115, 3120

TURBO MOLECULAR PUMPS

SARGENT-WELCH SCIENTIFIC COMPANY
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41-6437

General Description

Model 3121 greased bearing conversion kit converts the following pumps from oil lubrication to grease lubrication: 3102, 3103, 3106, 3115, 3120. Sufficient parts are provided to convert any of the models. Some parts may be left over.

Conversion of Transmission

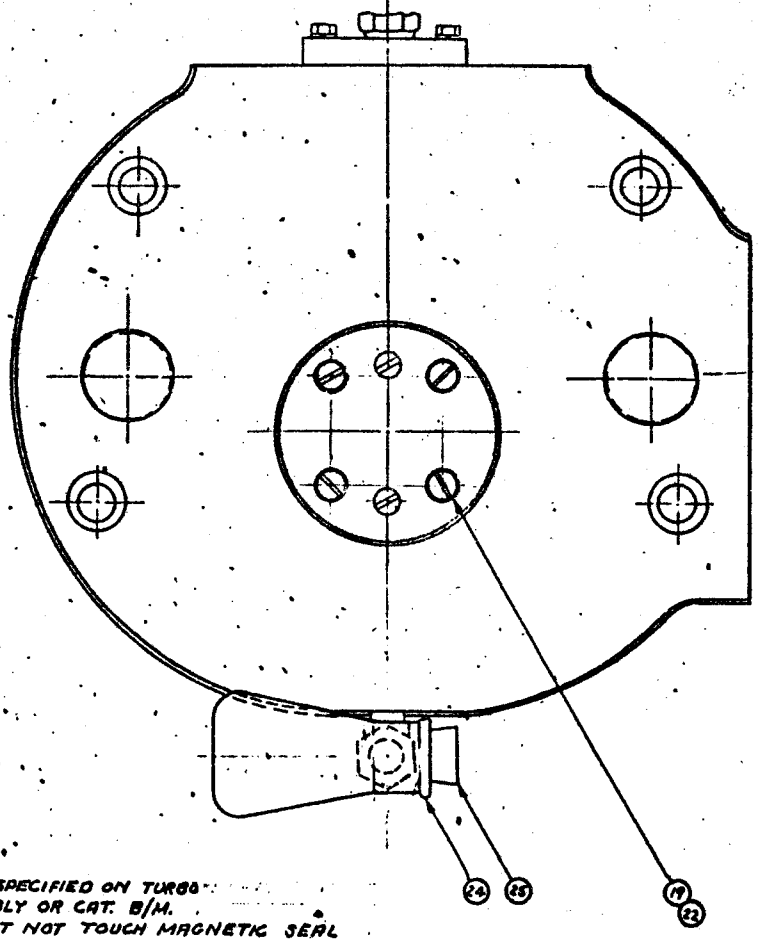
Remove the belt guard. Remove the transmission.

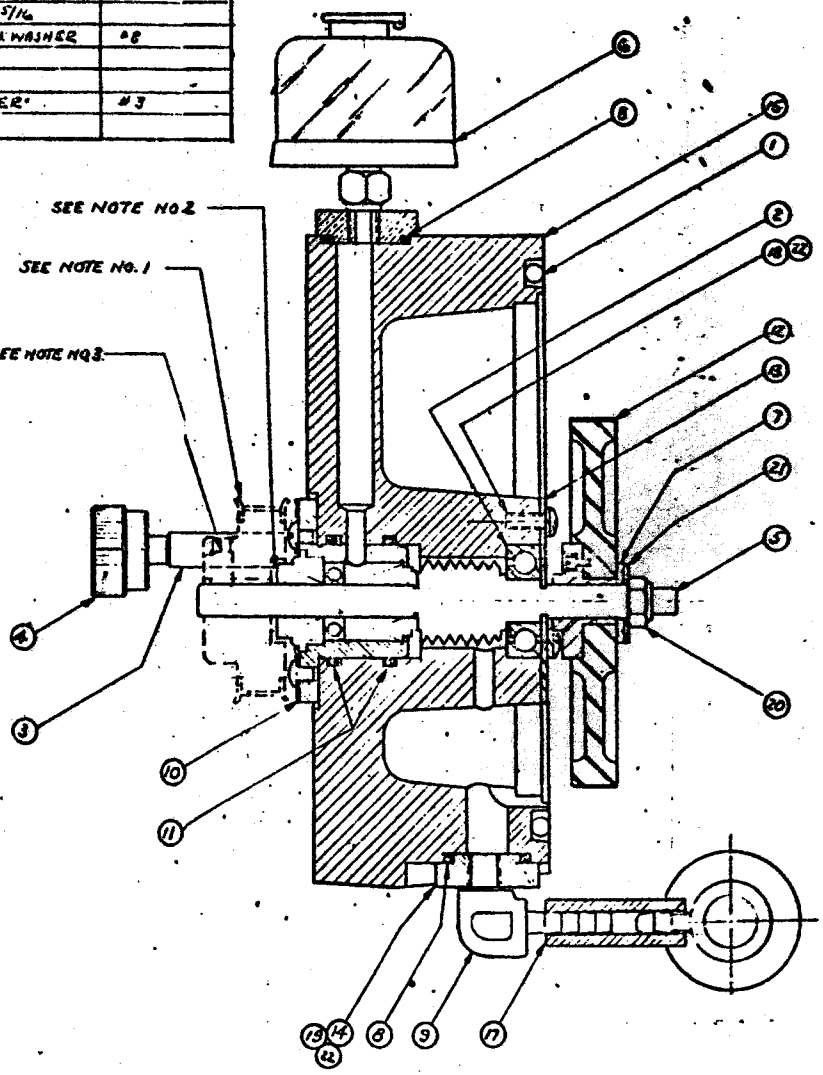
Take off the fiber gear as follows: Remove the nut located next to the fiber gear; applying one wrench on the nut and another wrench (adjustable) securely on the flats on the adjacent shaft end. Remove the conical spring washer. Pull off the gear. If the gear does not come off easily, it may be that the conical washer raised a burr on an edge over which the gear must slide. Find the burr and file it down carefully. Remove the three screws which retain the large cut out plate. Discard the plate. File a groove adjacent to the bottom drain of the transmission as shown in Figure 1 . Only the bottom of the groove is important. The groove can be made with a round file from 1/4" diameter to 1/2" diameter. The bottom of the groove should come almost to the large "O" ring groove as shown in the figure. Carefully wash away all filings and break any sharp edges.

The large ball bearing retained by the circular plate which was previously removed must be packed with red grease 41-6435. In older pumps, this bearing has a shield in the way which must be removed. The shield is thin sheet metal held at its outside diameter by a shallow notch in the outer ring of the ball bearing. The shield is removed by "rumpling" it radially inward by striking radially inward with the point of a "diamond shaped" small chisel. The chisel point is inclined at a flat angle to the shield so that the point will not strike the ball separator hidden underneath. Stand the transmission on the gear end of the shaft for a few minutes so that the oil will drain out of the bearing. Pack the bearing with 41-6435 red grease. Replace the large plate previously removed with bearing retainer plate 41-6127. Slide on the gear with the metal hub side toward the bearing. Slide the two washers over the shaft with the concave side of the conical washer next to the fiber gear. Mount the nut and tighten, being careful to hold the washers centered so that, as the cone washer flattens, it does not raise a burr on the shaft.

NO. REQ'D	PART NO.	ITEM NO.	ITEM	REMARKS	NO. REQ'D	PART NO.	ITEM NO.	NAME	REMARKS
1	41-3775	1	"O" RING 5 1/4 I.D. x 1/4	BUNA N	1	41-6128	14	FLANGE	
1	41-3983	2	DRIVE SHAFT BRG. - RIGHT	NOTE 4		41-6129	15	TRANSM. HOUSING, MACHINED	
2	41-4092	3	BELT GUARD STUD				16		
2	41-4093	4	KNURLED THUMB NUT		1	1-69-3132	17	POLYVYNYL TUBING 1 1/2 LONG	
1	41-4367	5	DRIVE SHAFT		3	2-00-1408	18	BIND HD. MACH. SCR. 8-32 x 1/2	
1	41-4582	6	OILER ASSEMBLY		6	2-26-2610	19	FIL. HD. MACH SCR. 8-32 x 5/8	
1	41-4707	7	SPRING WASHER		1	2-36-5400	20	ELASTIC STOP NUT 3/8-24	ENSH.
2	41-4744	8	"O" RING 3/4 x 15/16 x 3/32	BUNA "N"	1	2-61-0300	21	PLAIN WASHER 5/16	
1	41-4919	9	ELBOW		7	2-69-6108	22	STN. STL. SPLIT LOCK WASHER	#8
1	41-5430	10	SEAL CARTRIDGE				23		
2	41-5411	11	MICROSEAL "O" RING 1 3/16 I.D. x 3/32	BUNA "N"	1	41-6513	24	25 ml FLASK	
1	41-5558	12	GEAR, SPUR PHENOLIC		1	41-6514	25	RUBBER STOPPER	#3
1	41-6127	13	FRONT BEARING RETAINER				26		

41-6121

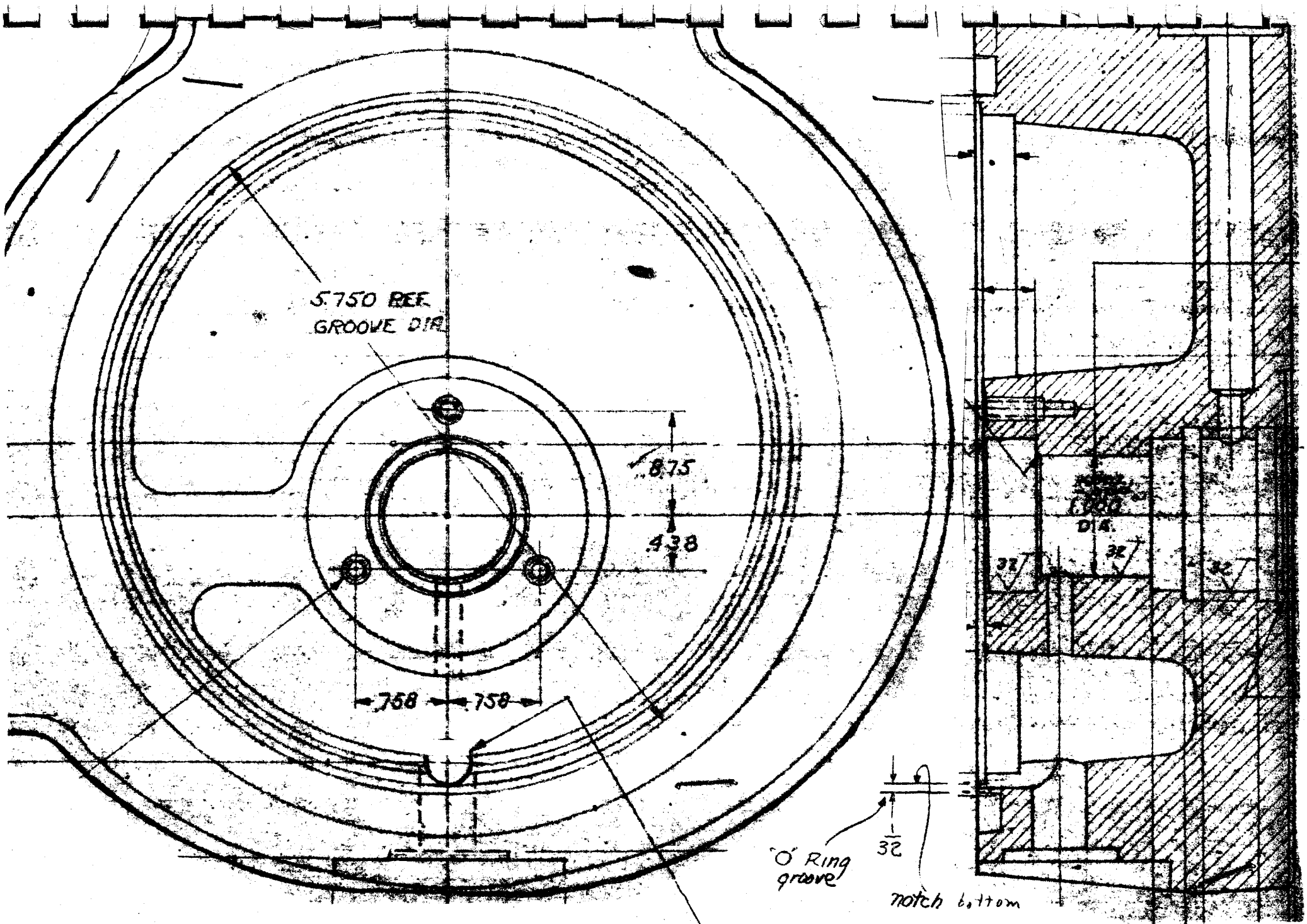




NOTES:
1. PULLEY AS SPECIFIED ON TURBO SUB-ASSEMBLY OR CAT. B/M.
2. PULLEY MUST NOT TOUCH MAGNETIC SEAL

FIG. 1

TRANSMISSION ASSEMBLY GREASE LUBED TURBOS	Sargent-Welch Scientific Company
3420 G, 31066, 41-6340	DRAWN J.R. DATE 3-11-74
MATERIAL NOTED	FINISH NONE
SCALE FULL	41-6121



Field modification to provide seal drainage

FIG. 1a

Notch can be "V", half round, or hack saw cut; notch bottom is only im[illegible]

41-6437

Remove the oil level window and the oil flow indicator window parts from the side of the transmission.

Fill the small recess with the 3/4" I.D. "O" ring (41-4744) and the 3/4" O.D. filler disk (41-6433). Fill the larger recess with the 1-3/8 I.D. "O" ring (41-4743) and the 1-3/8" filler disk (41-6434). The above items are retained by the rectangular aluminum cover plate 41-6432 and filister head machine screws 8-32 X 1/2 (2-20-2608).

At the top of the transmission are two holes to be closed with blank flanges 41-4382, 3/4" I.D. "O" ring 4744 and with filister head machine screw 8-32 X 5/8 (2-20-2610). One of these two holes, which served as an oil fill, is already provided with a blind flange. The other hole is to be closed by using the transmission drain blind flange and its "O" ring.

The shaft seal seepage collector must now be assembled and connected to the drain hole at the bottom of the transmission. Figure 1 shows these parts with self-explanatory clarity. The 1/8" type joint is sealed with Loctite 92-14 pipe sealant (1-99-5282).

Conversion of Turbo Housing

Remove the 3/8" oil drain tube and fittings (located under the pump) which interconnect the front and back end plates. Plug openings with plug 41-5958.

On model 3120, the 1/8" elbow fittings in the feet of the turbo are to be removed and replaced with 1/8" pipe plugs (41-5405) sealed with Loctite 92-14 Teflon Sealant (1-99-5282).

In the model 3106, the 1/4" tubing assembly at the bottom of the pump is to be removed and discarded. Save the "O" rings and the retaining screws. Cover the openings with blank flanges 41-4382 and use the "O" ring and retaining screws previously set aside.

If no coolant is to be used, remove the 5/16 tubes and fittings which provide the coolant connection to and between the end plate. The openings into the end plate do not need to be plugged.

Remove the 1/4" oil supply tubes and fitting which enter the end plate about 45° from the top of the end plate. Plug the opening with penetrable plug 41-6436 after blowing out to remove oil.

Remove all 1/2" pumpout tubes, if any, from transmission and back bearing end cap. Back bearing end caps provided with 1/2" tube connections are to be replaced with end cap 41-3928, using socket hd. cap screws 5/16-18 X 1" (2-21-6316).

In the models 3102 and 3103, remove the 3/8" tube under the turbo which interconnects the two end plates. Remove the mating fittings from the end plate. Replace the fitting with plugs 41-5958.

If pump came with aluminum butterfly restriction valve, turn the valve to open position and always leave it there Valve no longer has any function and can be eliminated if this is otherwise desirable. Remove the plastic tubes from the connector adjacent to the aforementioned valve and plug metal stub tubes with 41-6477 rubber stoppers. Cut off stoppers so they cannot be knocked out. This connector also no longer has any function and can also be eliminated if otherwise desirable.

Installing 41-5639 Ball Bearings

All of the now discontinued models 3102 and 3103 turbos were equipped with ball bearings having ten balls.

To avoid contaminating the special long running vacuum grease used on the main bearing in grease lubricated pumps, it is necessary to remove the oil from the bearings and adjacent passages.

To extend the period between re-greasing of the rotor bearings, and to decrease the rotor bearing friction and consequent temperature rise, grease lubricated turbos are fitted with ball bearings identical to those previously used except that every other ball has been left out, giving a ball bearing with only five balls. A set of these bearings (41-5639) is provided with the 3121 conversion kit. These bearings are packaged by the manufacturer in oil and this oil must be removed immediately before initial greasing.

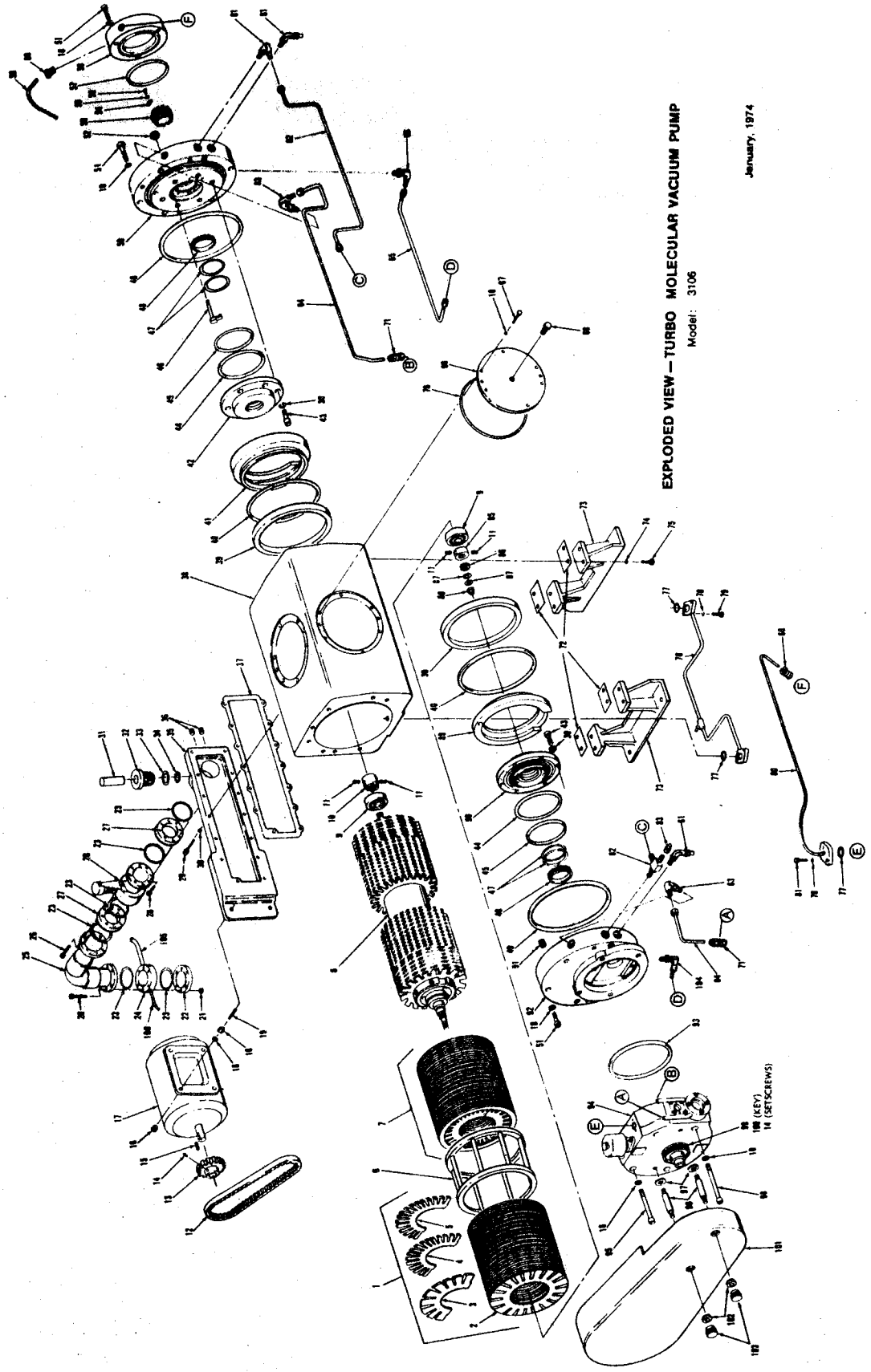
The procedure for replacing bearings is basically the same in models 3102, 3103, 3106, 3115 and 3120 turbos. The instructions in the following section Rotor Bearing Replacement are taken from the 3106 manual. The exploded view associated with these instructions is applicable to all the aforementioned models insofar as the replacement of bearings is concerned. All these models use interchangeable end plates and bearing support parts 41-6437.

The exploded view and parts list furnished herein show the ball bearing sliding in steel bearing mounts which, in turn, are resiliently supported by an "O" ring. Pumps made before 1974 have the bearings supported directly in rectangular cross section rubber rings. The change to the steel sleeves eliminated a source of bearing failure caused by bonding of the rubber to the bearing outer race, thus preventing free expansion of the rotor when warmed by normal friction of running or by bakeout. If the pump to be converted is running satisfactorily, the old mounting arrangement can be used. If not, we suggest that you discuss with the Sargent-Welch representative changing the bearing mounts at the time the bearings are replaced for grease lubrication. Special caution is necessary when removing the bearing retaining nut on the 3120 turbo shaft because of the danger of damaging the aluminum threads. If the nut starts to bind, do not force it any further; but, rather screw it back in place. Postpone changing to the 5 ball bearing. Consult with your Sargent-Welch representative about changing the bearing some time in the future. Grease the existing bearing according to the following procedure just as if it were a new bearing.

After the new bearing is mounted, wash off the oil in which the bearing was packed using benzene or gasoline. The manufacturer of the bearings recommends that no chlorinated solvent (such as trichlor) be used to clean bearings. Evaporate the solvent with a warm air stream. The bearing may be turned slowly by hand but the manufacturer recommends that a dry bearing never be spun. Immediately after the odor of solvent has gone from the bearing, use the syringe to apply a very thin film of grease in the bearing grooves. Use as little grease as possible and stop when the sound and feel of the bearing indicate that the surfaces are lubricated. The procedure calls for the bearing to be fully packed at a later stage of the conversion. The bearing will only have to run for half an hour or so on this light lubrication.

Before the transmission is mounted to the pump, put a spoonful of the red grease 41-6435 in the end plate of the pump so that when the gear is pushed in place, the grease will come in contact near the outside diameter of the gear.

Our tests so far have not shown any need for regreasing the large ball bearing in the transmission or regreasing the gear. Only the main bearings need to be periodically regreased.



Complete Pump Exploded View with Parts Identification

Parts List for Main Assembly

Call Out	Part No.	Description
1	41-5275	Stator disc set & spacers, left screw
2	41-3908	Stator disc, 2nd stage, left screw, 20 teeth, not split
3	41-3908	Stator disc, 2nd stage, left screw, 20 teeth, split
4	41-3906	Stator disc, lst stage, left screw, 48 teeth
5	41-4235	Stator disc, 1st stage, left screw, 88 teeth
6	41-5432	Inlet stator-spacer assembly
7	41-5276	Stator disc set & spacers, right screw
8	41-5242	Rotor assembly
9	41-5639	Rotor bearing
10	41-3932	Back bearing locknut
11	2-10-8603	Slotted headless set screw 8-32 x 3/16
12	41-5291	Timing belt
13	41-5290	Motor pulley
14	2-91-8104	Headless slotted nylon set screw 1/4-20 x 1/4
15		Key, standard, straight, supplied with motor
16	2-51-9301	Jam nut, SST. 5/15-18
17	41-5241	Drive motor, 1/3 HP, 3 Ph. 230/460 V
18	2-69-9902	Split lockwasher SST. for 5/16 bolt
19	41-5193	Studs 5/16-18 x 1 11/16 SST.
20	2-21-0120	Hex. head cap screw, SST. 1/4-20 x 1 1/4
21	2-52-0112	Hex. nut SST. 1/4-20
22	41-5972	Blind flange 2" A.V.S. Type
23	41-4580	Tetraseal 2 1/8 x 2 1/4 x 1/16
24	41-6000	Pump out flange assembly
25	41-6024	Flanged elbow connector
26	2-21-0114	Hex. head cap screw SST. 1/4-20 x 7/8
27	41-4581	Flange gasket 2" A.V.S. Type
28	41-5425	Throttle valve assembly
29	2-21-6120	Soc. head cap screw SST. 1/4-20 x 1 1/4
30	2-69-9901	Split lockwasher, SST. for 1/4 bolt
31	41-4146	Plug, quick vacuum coupling
32	41-4796	3/4" quick disconnect body
33	41-4797	Spacer, quick disconnect
34	41-2487	O-ring 3/4 I.D. x 1 O.D. x 1/8 W
35	41-5233	Outlet manifold
36	41-5405	Headless pressure plug, 1/8-27 NPTF
37	41-5232	Outlet manifold gasket
38	41-5234	Turbo housing assembly
39	41-5364	Adapter thrust ring
40	41-5192	O-ring, 7 I.D. x 7 1/4 O.D. x 1/8 W
41	41-5249	Thrust ring — rear
42	41-4730	Oil catcher — back
43	2-21-6112	Soc. Head SST. cap screw 1/4-20 x 3/4
44	41-4218	Tetraseal, 4 3/4 I.D. x 5 O.D.
45	41-4219	Tetraseal, 3 1/2 I.D. x 3 3/4 O.D.
46	41-3972	Clamp bolt
47	41-5638	O-ring 2 I.D. x 2 1/8 O.D. x 1/16 W
48	41-5531	Steel bearing mount
49	41-3973	O-ring 7 3/4 I.D. x 8 1/4 O.D. x 1/4 W
50	41-3926	Back cover plate
51	2-21-6324	Soc. head cap screw, SST. 5/16-18 x 1 1/2
52	41-5538	Elastic stop nut 1/4-28
53	41-3907	Back bearing adjusting nut

Call Out	Part No.	Description
54	41-3908	Locking plate
55	2-62-0432	Split lockwasher stl. #6
56	2-00-2406	Fillister-head machine screw 6-32 x 3/8
57	41-2481	O-ring 3 5/8 I.D. x 4 O.D. x 3/16 W
58	41-5667	End cap
59	41-5961	Outlet tube
60	41-5642	Nut and seal
61	41-4094	Elbow, 5/16 tube SST. with nut and sleeve and O-ring
62	41-4716	Coolant tube assembly
63	41-5539	Elbow, 1/4 tube
64	41-5258	Oil tube—rear
65	41-5266	Oil return line
66	41-5540	Elbow, 3/8 tube (oil return)
67	2-21-0316	Hex. head cap screw SST. 5/16-18 x 1
68	41-4000	Plug with O-ring
69	41-5252	Blank inlet flange
70	41-5003	O-ring 6 1/4 I.D. x 6 1/2 O.D. x 1/8 W
71	41-5498	Sealastic fitting
72	41-5299	Insulating gasket
73	41-5256	Mounting base
74	2-69-9903	Split lockwasher, SST. for 3/8 bolt
75	2-21-0520	Hex. head cap screw SST. 3/8-16 x 1 1/4
76	41-5272	Oil drain line
77	41-4744	O-ring 3/4 I.D. x 15/16 O.D. x 3/32 W
78	2-69-6108	Split lockwasher SST. #8
79	2-20-2614	Fillister-head machine screw, SST. 8-32 x 7/8
80	41-5962	Crossover tube assembly
81	2-20-2610	Fillister-head machine screw, SST. 8-32 x 5/8
82	41-4095	Tee—5/16 tube
83	41-5293	Cap—5/16 tube
84	41-5260	Oil tube front
85	41-3931	Front bearing locknut
86	41-5556	Spur gear, rotor, 19 teeth, 24 pitch
87	41-4732	Spring washer, 3/8-10 x 5/8 O.D.
88	2-36-5690	Elastic stop nut 3/8-24 UNF-33
89	41-5248	Thrust ring—front
90	41-4731	Oil catcher—front
91	41-3991	Thrust spring
92	41-3924	Front cover plate
93	41-3975	O-ring 5 3/4 I.D. x 6 1/4 O.D. x 1/4
94	41-5240	Transmission assembly
95	2-21-6348	Soc. head cap screw, SST. 5/16-18 x 3
96	41-4092	Belt guard stud
97	41-5325	Flat washer—Neoprene
98	1-21-6356	Soc. head cap screw, SST. 5/16-18 x 3 1/2
99	41-5181	Driven pulley
100	41-5923	Key, 3/32 x 3/32 x 9/16
101	41-5255	Belt guard
102	41-4086	Insulated bushing
103	41-4093	Knurled thumb nut
104	41-4173	Check valve elbow (red, early serial nos.)
105	1-69-6130	Polyurethane tubing 7/16 I.D. x 5/8 O.D. x 12 Long
106	1-69-3132	Polyurethane tubing 1/4 I.D. x 1/2 O.D. x 20 Long
	41-5663	Instruction manual

6-5 Rotor Bearing Replacement

Remove knurled thumb nuts (103). Pull off belt guard (101). Slip off toothed belt (12). Disconnect lubricating oil lines at connectors. Remove transmission pump-out at flange at top of transmission.

Remove the small capillary refrigerant connectors at fitting (61) where they enter the turbo on both ends. The charge of refrigerant will escape. Refrigerant must be replaced later.

Remove coolant line (64). Remove oil line (67).

Drain oil from transmission at drain cap on bottom of transmission (99). Remove oil drain lines (65) passing underneath the pump from front to back. Remove transmission mounting screws (98) and (95). As the screws come loose, support transmission (94) to prevent falling. Withdraw transmission.

To take off front end plate (92), remove the four socket head screws (51). Pull the end plate straight back off bearing and set it, outer face down, on a piece of cardboard so as not to scratch the machined sealing surface or lose the springs. Rotor rests on its outside diameter.

The front end bearing can now be inspected. The ball separator which maintains correct spacing between the balls should be intact, with all rivets in place and the aluminum reinforcing ring without fracture or distortion. The condition of the bearings can be judged by pushing the outer race of the bearing axially while rotating it so as to maintain firm ball contact during one or more revolutions of the outer race. Repeat while pulling on the outer race. Deterioration of the balls or ball races causes a rough or "catching" sensation when this test is made. A new bearing in perfect condition will feel extremely smooth. Spinning the outer race of the bearing and listening for noises is misleading, because the balls and separator are very loose due to the clearance which is normal in the bearing selected for this pump. (Normal axial play is as much as .010 inch.) Black sludge deposits are often seen on and around the bearings. This sludge is harmless and need not be washed off.

If it is decided that the front end bearings should be replaced, remove elastic stop nut (88) next to gear. To counter wrench torque, reach in through one of the pump inlet openings and grasp the rotor. Otherwise, set the wrench squarely on the nut and rap quickly with a hammer, using the inertia of the rotor as the counter-torque. Remove spring washers (87) and pull off gear (86). Remove set screws (11) with a screwdriver ground to fit the slot accurately to avoid deformation of the soft brass screws. The screwdriver blade should be narrow enough to avoid cutting and deforming the threaded hole. Use a spanner wrench to grasp inner race bearing retainer nut (85). Break the nut (85) loose with a sharp counterclockwise rap on the wrench. Pull off the bearing. The bearing is normally loose enough to slide off by hand, but sometimes a light force using a wheel puller is necessary. If a wheel puller must be used, be careful not to damage the fine threads on the end of the shaft. A wheel puller is capable of applying enough axial force on the balls between the inner and outer race to dent the races.

A bearing removed with the puller should never be used again unless only finger torque on the puller was necessary. When removing or installing close fitting parts, such as the bearings, it is important that the pull be even and not more on one side than on the other. Unbalanced pull can cause jamming of such fits.

Remove the new bearing from its protective package and install without attempting to wash off the preservative oil. Before the bearing is pushed home on its seat, make sure that no particles have fallen on the bearing seat that might prevent square seating of the bearing. The bearing should slide on with a hand-push fit. Even the slightest dent on the bearing seat made by mishandling tools can prevent the bearings from going on freely. Burrs raised by such dents can be removed using a hard white abrasive stone (typical HF-43-Hard Arkansas by Behr-Manning Div. Morton Co.). Never use abrasive cloths or files on the bearing seat to make the bearing go on.

After the new bearing is in place, stone off any raised burrs that may have been put on the bearing nut (85) because the outside diameter of this nut is a rather close running fit in adjacent parts. Make sure that the brass set screws (11) run freely in and out

of the nut and that the set screw slots are in good condition. Use new set screws if available. Wash the nut off thoroughly so that no chips remain which might get into the bearings. Screw the nut on with the set screws retracted. Seat the nut with a sharp rap on the spanner wrench. Tighten set screws. Slide on gear (86). Slide on two cone spring washers (89) with cones nested. Screw on elastic stop nut (88) and tighten with a sharp rap on wrench.

Normally both front and back bearings are inspected because it is impossible to distinguish between the bearings as sources of noise or vibration. Now proceed to back bearing as follows.

Remove back bearing cap (58) by removing cap retaining screws (51). It is now necessary to disconnect four hook bolts (46) which are hooked around the outer race of back ball bearing (9) and which would prevent the withdrawing of the end plate (50). The four hook bolts (46) are retained by four elastic stop nuts (52). To disconnect a hook bolt, push forward and simultaneously turn retaining nut (52) counterclockwise. A small prick mark on the threaded end of the hook bolt (46) protruding through retainer nut (52) shows the position of the hook. When the hooks are engaged these marks are toward the axis of the pump. When the hooks release the outer race of the back bearing (9), the hook and the locating prick mark will turn about 45° counterclockwise suddenly. Make sure that all the hooks are in this position when the end plate is subsequently withdrawn. Remove plate retaining screws (51).

Pull off end plate (50) with a rocking motion. Once end plate (50) is removed, the back bearing (9) can be inspected in the same manner as described previously for the front bearing. The replacement process is also the same.

Inspect the bore of the oil catchers both front (90), and rear (42) when the end plates are removed. These bores normally have about .007 inch radial clearance at the mating rotor shoulders. If there has been a rub, marks can be seen on the rotor shoulders and evidences of galling can be seen on the oil catcher (90) (42) bores. Scrape any galled aluminum from the rotor with a knife and emery paper. Be sure to remove all chips and grit before reassembly.

Reassembly can now begin. Put the back end plate (50) on first. Make sure that the hook bolts (46) are rotated so that the back bearings (9) can enter the end plate (50). Install back end plate retaining screws (51). Rotate the hook bolts (46) into the engaged position by rotating the elastic stop nut (52) clockwise until the prick marks on the ends of the hook bolts (46) are radially inward indicating that the tips of the hooks are engaged with the outer race of the back bearing (9). When the hook bolts are in this position, and one is pulling and turning on the hook bolt retaining nut (52), it will be noticed that the hook bolts cannot be swung through a very large angle. This further indicates that the hook bolt tip is in the correct position to engage the outer race of the back bearing (9). It is now possible to tighten the retainer nuts (52) until the hook bolts (46) barely contact the outer race of the back bearing (9). The rotor should be pushed firmly toward the back end of the pump so that the back side of the outer race of the back bearing (9) is squared firmly against the face of rotor positioning nut (53). Now adjust the four nuts (52) so that the tips of the hooks have a very light scraping contact with the outer race of the bearing when the nuts (52) are pushed lightly forward and lightly turned. The object of this manipulation is to place the tips of the hook bolts (46) all in the same plane, so that, should the bearing outer race push against the tips of the hook bolts (46), the tips will be in a plane perpendicular to the axis of rotation of the bearing and hold the bearing square with the axis of rotation without significant radial restraint from the hooks. This allows the O-ring floated bearing mounts to perform their vibration isolation function.

Now the front end plate (92) can be put back on. Make sure that thrust springs (91) are in place. These springs can be temporarily retained with thick grease. Tighten screws (51) evenly. Make sure the pilot diameter on the front face of front end plate (92) enters the opening in the turbo housing squarely and does not catch on one edge.

If the adjusting locking nut bar has been removed and the adjusting nut (53) position has been moved from its original position, the rotor must be re-centered between the stator disks. **NOTE:** During this operation,

the front rotor ball bearing is supposed to slide through the front mount.

Back rotor adjusting nut (53) off four turns. Verify that rotor can be pushed back and forth with thumbs on rotor ends with rotors pressing on stators at ends of movement. Move the rotor toward the front of the pump by turning the bearing adjusting nut (53) clockwise. The rotor should still be spinning. Continue screwing the adjusting nut in slowly until a definite scraping or ticking is heard, then stop. Assuming that the rotor has been pushed slowly by turning the adjusting nut, and the scraping or ticking noise is heard, place an obvious pencil mark on both the adjusting nut and the back cover plate to mark this point of adjustment. Back out the adjusting nut (53) **exactly** one full turn.

Hook the clamp bolts (46) onto the rotor bearing outer race by facing the punch marks toward center and gently tightening the elastic stop nuts (52). When all the clamp bolts are in place, begin tightening the stop nuts alternately to draw the rotor toward the back of the pump. Spin the rotor again and listen for the scraping or ticking noise. In some cases, the rotor might not scrape before the rotor bearing is stopped by the adjusting nut. In that case, back out the adjusting nut an additional **exactly** recorded amount, perhaps a half turn, and continue.

When the rotor is heard to scrape the stators, screw in (clockwise) the adjusting nut (53) until the scraping noise diminishes or just barely disappears, meanwhile observing the relative position of the adjusting nut with respect to its original setting. At this point the notches on the adjusting nut serve as ideal units of measurement. The adjusting nut will probably be from eight to eleven notches from its original setting. Count these notches. This is the amount of clearance from a forward scraping to a backward scraping of the rotor. For a correct adjustment, screw in the adjusting nut half the total number of notches, thereby moving the rotor midway between the stators. Adjust hook bolts (46) as described above.

Remount the transmission (94) by inserting screws (95) and (98). The play in the gears is adjusted by raising or lowering the transmission before the screws are tightened.

Initial Grease Pack

Materials:

8 41-6331 grease filled syringe
1 motor current meter S-W 3081T or equal fitted with starting shunt switch

Procedure:

1. Connect shunted meter in motor lead.
2. Evacuate and start turbo: when at full speed,
3. Open shunt: observe current.
4. Start grease injection on one end. Poke needle through middle of penetrable plug. Start grease injection to fill passages before grease gets to bearing. Three to four syringe fulls will be required. When a syringe is emptied, withdraw syringe and connected needle. The rubber plug closes vacuum tight behind the needle. It is not necessary for successive needle penetrations to be through the same hole. At about 9 cc, grease will start to reach bearing and current will show a slight rise. Inject 1 cc more. Current will rise about 50% over normal but should drop back down halfway to normal after less than 5 minutes. After current is holding fairly steady, even though above normal, note the current and use it as a "norm" to inject grease in other end similar to the previous procedure.
5. Current should return to normal after about 18 hours.
6. Note: Do not unscrew the penetrable plug. At atmospheric pressure, a small volume may be trapped when it is screwed back which will expand at vacuum conditions and push uncontrolled amounts of grease through the bearings.

Subsequent Regrease

Interval for 24 hour service
Maximum - Every 12 months (8,760 hours)
Minimum - Every 6 months (4,380 hours)

Materials:
1 41-6331 grease filled syringe
1 motor current meter S-W 3081T or equal fitted with starting current shunt switch.

Procedure:

1. Connect meter in one motor lead. Evacuate turbo and get up to full speed. Open meter shunt. Observe current.
2. Start grease injection in one end. Poke needle through middle of penetrable plug. Inject until a slight rise is noticed, then inject 1 cc more. Current will rise to about 50% over normal, but should drop back down halfway to normal after less than 5 minutes. After current is holding fairly steady, even though above normal, note the current and use it as a "norm" to inject grease in the other end similar to the previous procedure.
3. Current should return to normal after about 18 hours.
4. Note: Do not unscrew the penetrable plug. At atmospheric pressure, a small volume may be trapped when it is screwed back which will expand at vacuum conditions and push uncontrolled amounts of grease through the bearings.

Shaft Seal Seepage

The small flask under the transmission must be emptied from time to time. The turbo must be let up to atmospheric pressure to do this. The flask collects the small seepage of seal oil which passes through the rubbing faces of the seal to the forevacuum cavity.

Shaft Seal Oil

Just as in the oil lubricated pumps, keep the oil cup on the transmission at least 1/4 full of 3105K oil.

Repairs

Decontamination

The decontamination flush procedure for the grease lubricated turbos is the same as the oil lubricated turbos. However, the drains on the lower side at the two ends of the turbo body proper, permanently connected in the case of the oil lubricated model, are plugged in the 3120 and 3106 grease lubricated models. The plugs must be opened so that the flushing solvent can discharge after passing endwards through the turbo stages. In the model 3106, remove the two diamond shaped brass plugs at the ends of the turbo body for flushing. In the model 3120, the drain connects with the drilled foot crossbar. Remove one of the plugs in the foot crossbar at each end of the pump.

Shaft Seal Repairs

Shaft seal repairs are the same on oil lubricated and grease models.

Rotor Bearings

Follow the instructions given in the section Installing 41-5649 Bearings.

Operation

Roughing and Starting

The forepump restriction valve, if any, is always wide open.

Turn on the forepump (stop-start switch) and rough the system until a pressure of 1 Torr is reached at turbo outlet. It is permissible to turn on forepump and turbo at the same time if 1 Torr is reached in less than 3 minutes. The turbo is ineffective above 1 Torr.

Do not operate the forepump very long below 1 Torr without turning on the turbo; otherwise forepump oil vapor will eventually pass through the turbo into the chamber.

Turn on the turbo. It takes about three minutes for the turbo rotor to reach full speed. The rate of pressure drop is determined usually by the extent and nature of the system surface and the time they have been exposed to atmospheric water vapor.

For fast cycling, the contents of a chamber at atmospheric pressure may be "dumped" into the turbo inlet while the rotor is running full speed. Only a momentary slow-down of the rotor occurs.

The only limit to such cycling is overheating of the drive motor. When the motor temperature limit is reached, the thermal overload in the motor will switch it off. No damage occurs. Restart is automatic after about 10 minutes cooling. (Caution: Keep hands clear of belt.) If turbo motor overheats, install a pressure switch to energize the motor only below 10 Torr; or, alternatively, extend the cycle time.

The fastest cycling is with a separate, very large roughing pump. The turbo is valved in and the roughing pump valved out below 10 Torr but above 1 Torr. The turbo is on continuously.

Shutdown

Turn off the turbo. Leave forepump running. Vent to atmosphere through the turbo inlet. When turbo pulley has stopped, turn off forepump.

Another procedure is to let the turbo stop with forepump running, then vent immediately through the inlet. A very slight (usually insignificant) contamination will occur.

SHEET OF

SUMMARY BILL OF MATERIAL FOR – CAT 3121 3103

GREASED BEARING CONVERSION KIT (3102, 3106, 3115, 3120)

COMPLETED — DATE / QUAN

P.O. NO. — DATE — QUAN.

CAT. NO. 3121

AMT	1	2	3	ITEM	MEASURE QUAN.	MEASURE UNIT	ITEM NO.	ORDER NO.	DATE	QUAN.	REC'D	COST
1				INSTRUCTIONS			41-6437					
1				END CAP			41-3928					
3	8			GREASE FILLED SYRINGES			41-6331					
2				PLUG WITH "O" RING · 1/4 TUBE			41-5957					
2				PLUG WITH "O" RING · 3/8 TUBE			41-5958					
3				PIPE PLUG - 1/8 SIZE			41-5405					
2				BALL BEARINGS FOR ROTOR (5 BALL)			41-5639					
1				2 OZ. JAR MOBIL 28 RED GREASE			41-6435					
1				OIL INDICATOR REPLACEMENT COVER PLATE			41-6432					
3				SOC. HD. CAP SCREWS 5/16-18 x 1"			2-21-6316					
1				25ml FLASK			41-6513					
2				"O" RING - 3/4 I.D. x 15/16 O.D.			41-4744					
1				FLANGE, TAPPED 1/8 NPT			41-6128					
1				ELBOW, 1/8 MALE NPT TO HOSE			41-4819					
2				FIL. HD. MACH. SCR. 8-32 x 5/8			2-20-2610					
1				"O" RING - 1 3/8 I.D. x 1 9/16 O.D.			41-4743					
8				FIL. HD. MACH. SCR. 8-32 x 1/2			2-20-2608					
1				LOCTITE 92-14 PIPE SEALANT W/ TEFLON			1-99-5282					
1				"O" RING FILLER PLUG FOR 3/4 I.D "O" RING			41-6433					
1				"O" RING FILLER PLUG FOR 1 3/8 I.D. "O" RING			41-6434					
2				PLUG, PENETRABLE BY GREASE SYRINGE			41-6436					
1				TUBE, POLYVINYL, 1 1/2 LONG			1-69-3132					
1				STOPPER, RUBBER #3			41-6514					
6				SET SCREWS, BRASS, SLOTTED, 8-32 x 3/16			2-10-8603					
1				CARTON								
1				LOCTITE GRADE H			1-99-5126					
3				BLANK FLANGES			41-4382					
2				RUBBER STOPPERS, MICRO			41-6477					
1				FRONT BEARING RETAINER			41-6127					
				Every part must be identified by piece number on envelope containing part.								

PREPARED BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE	REV.	B3547
AHM	4-7-75	CZ	4-9-75	G.O.	4-8-75	DATE	7-28-75

AHM